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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/810,654	03/15/2001	Kartik Venkataraman	DB000911-000	9516
24122	7590	07/01/2004	EXAMINER	
THORP REED & ARMSTRONG, LLP ONE OXFORD CENTRE 301 GRANT STREET, 14TH FLOOR PITTSBURGH, PA 15219-1425			SEALEY, LANCE W	
			ART UNIT	PAPER NUMBER
			2671	
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Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/810,654

Applicant(s)

VENKATARAMAN, KARTIK

Examiner

Lance W. Sealey

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 15 March 2001.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 5-11 is/are allowed.
- 6) ☒ Claim(s) 1-4, 12, 14-17, 19 and 21-23 is/are rejected.
- 7) ☒ Claim(s) 13,18,20 and 24 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>6</u> . | 6) <input type="checkbox"/> Other: _____  |

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**DETAILED ACTION**

***Allowed Subject Matter***

1. Claims 5-11 are allowed, and claims 13, 18, 20 and 24 are objected to as being dependent upon rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
2. The following is a statement of reasons for the indication of allowable subject matter: No prior art suggests or implies, in a process for operating on a dataset, converting primitives created by slicing a dataset into two dimensional slices according to a selected viewing plane to a set of fragments each having its own three dimensional texture coordinate (claim 5). Nor does any prior art suggest or imply, in a method of preprocessing a 3D dataset, calculating and storing density textures for each of said plurality of 2D primitives (claims 8, 13, 18, 20 and 24). Claims 6-7 are allowed because they depend on claim 5, and claims 9-11 are allowed because they depend on claim 8.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
  - (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
4. Claims 1 and 4 are rejected under 35 U.S.C. § 103(a) as being unpatentable over

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Pfister, "Architectures for Real-Time Volume Rendering" and Hochmuth et al.

("Hochmuth," U.S. Pat. No. 6,509,905).

5. Pfister, in discussing three special-purpose architectures for interactive volume rendering, applicable to the rendering of biomedical data (see "1 Introduction," first paragraph, p.1) also discloses, with respect to claim 1, a process for operating on a dataset ("3 Texture Mapping Hardware," p.3; the process begins with a volume stored in texture memory) comprising defining a plurality of slicing planes through the dataset, said slicing planes being parallel to a viewing plane (texture slices in Fig.3(b)); interpolating density values for the figures generated by the intersection of the dataset with the slicing planes (interpolation of density values not explicitly disclosed, but interpolation of texture data is disclosed in the first paragraph of "System Architecture," p.4. However, it would have been obvious to a person skilled in the art at the time the invention was made that interpolation of texture data in biomedical applications would include interpolation of density values, and an illustration of this can be found in the description of VIRIM, another architecture in the Pfister article which implements a biomedical application, in which voxel values are mapped into density values before interpolation, see Fig.8 and the first paragraph of "System Architecture," p.5); and storing the density values for later use (storing of texture samples is disclosed in the first paragraph of "System Architecture," p.5; it would have been obvious to a person skilled in the art at the time the invention was made that storing of texture samples would include storing of density values in biomedical applications for the same reason that interpolation of texture data in biomedical applications would include interpolation of density values).

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6. However, Pfister does not disclose operations in normalized device space. This element is disclosed by the Hochmuth method and apparatus for performing a perspective projection in a graphics device of a computer graphics system at col.4, ll.31-37.

7. Therefore, it would have been obvious to a person skilled in the art at the time this invention was made to have combined the Pfister texture mapping architecture with the Hochmuth perspective projection apparatus. Operating in normalized device space is essential to accomplish perspective projections, which increase realism (Hochmuth, col.1, l.63 to col.2, l.8).

8. Concerning claim 4, Pfister discloses transforming the dataset to a new viewing plane (see description of Fig.4(d), p.4: "Gradients are estimated using central differences between axis aligned texture slices in all three dimensions.")

9. Accordingly, in view of the foregoing, claims 1 and 4 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Pfister and Hochmuth.

10. Claims 2-3 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Pfister and Hochmuth and further in view of Oikawa et al. ("Oikawa," U.S. Pat. No. 5,630,034).

11. With respect to claim 2, neither Pfister nor Hochmuth disclose rasterizing the figures generated by the intersection of a dataset with slicing planes. However, these elements are disclosed by the Oikawa three-dimensional image producing method and apparatus at col.13, ll.14-18; this process is accomplished by rendering unit 23, FIG.1 (see col.12, l.66), and this calculation of densities of voxel data eventually leads to rasterization of the figures (see col.17, ll.43-45).

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12. Therefore, it would have been obvious to a person skilled in the art at the time this invention was made to have combined the Pfister-Hochmuth texture mapping architecture with the Oikawa three-dimensional image producing method. This enables scans to be performed at finer intervals so that more information can be gathered for more detailed rendering (Oikawa, col.13, l.34).

13. Concerning claim 3, neither Pfister nor Hochmuth disclose interpolating a density value by analyzing the density values assigned to a predetermined number of nearby points. However, these elements are disclosed by Oikawa at col.12, l.66 to col.13, l.6.

14. Therefore, it would have been obvious to a person skilled in the art at the time this invention was made to have combined the Pfister-Hochmuth texture mapping architecture with the Oikawa three-dimensional image producing method. This increases processing speed by facilitating location of the position of the area to be displayed which is closest to the projection plane (Oikawa, col.12, l.66 to col.13, l.6).

15. Accordingly, in view of the foregoing, claims 2-3 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Pfister and Hochmuth.

16. Claims 12 and 14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Pfister in view of Oikawa.

17. Pfister, as stated earlier, discloses, with respect to claim 12, a process for operating on a dataset, comprising: defining a plurality of slicing planes through the dataset ("3 Texture Mapping Hardware," p.3; the process begins with a volume stored in texture memory), said slicing planes being parallel to a viewing plane (texture slices in Fig.3(b))).

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18. However, Pfister does not disclose rasterizing each of said plurality of primitives, and storing the values produced by the rasterizing step for later use. These elements are disclosed by the Oikawa three-dimensional image producing method and apparatus at col.13, ll.14-18; this process is accomplished by rendering unit 23, FIG.1 (see col.12, l.66), this calculation of densities of voxel data eventually leads to rasterization of the figures and their storage for later use (see col.17, ll.43-45--rasterization is the "provid[ing] of a desired (2D) image efficiently" and the "storage of the values for later use" is the presumable storing of the 2D image before it is displayed).

19. Therefore, it would have been obvious to a person skilled in the art at the time this invention was made to have combined the Pfister texture mapping architecture with the Oikawa three-dimensional image producing method. This enables scans to be performed at finer intervals so that more information can be gathered for more detailed rendering (Oikawa, col.13, l.34).

20. Regarding claim 14, Pfister discloses transforming the dataset to a new viewing plane (see description of Fig.4(d), p.4: "Gradients are estimated using central differences between axis aligned texture slices in all three dimensions.")

21. Accordingly, in view of the foregoing, claims 12 and 14 are rendered unpatentable under 35 U.S.C. 103(a) by Pfister and Oikawa.

22. Claim 15 is rejected under 35 U.S.C. § 103(a) as being unpatentable over the OpenGL Reference Manual in view of Chauvin et al. ("Chauvin," U.S. Pat. No. 5,886,701).

23. OpenGL, a product of the Silicon Graphics Corporation which consists of

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commands used for producing graphics, also discloses operating a rendering pipeline on a volumetric dataset in a feedback mode to prevent the rendering of the dataset at the first full paragraph of p.16 (the paragraph names three modes—selection, feedback and rendering—and states that of these three modes, only the rendering mode results in rendering.)

24. However, OpenGL does not disclose storing the results produced by the feedback mode of operation for later use in a rendering operation such that the later rendering operation is reduced to a compositing problem. These elements are disclosed by the Chauvin graphics rendering device and method. Storing the results produced by the feedback mode of operation for later use in a rendering operation is disclosed at col.49, ll.50-54. The reduction of the later rendering operation to a compositing problem is disclosed at col.50, ll.10-19.

25. Therefore, it would have been obvious to a person skilled in the art at the time this invention was made to have combined the Chauvin graphics rendering device and method with the OpenGL method of producing graphics. This enables advanced lighting and shading operations to be supported (Chauvin, col.50, ll.17-19).

26. Accordingly, in view of the foregoing, claim 15 is rendered unpatentable under 35 U.S.C. 103(a) by the OpenGL Reference Manual and Chauvin.

27. Claims 19 and 21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Pfister.

28. Concerning claim 19, Pfister does not directly disclose using texture values as pointers for retrieving information from a lookup table. However, the third through fifth



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sentences in “3 Texture Mapping Hardware”, p.3, begin with extracting textured planes parallel to an image plane, continue with using a lookup table, and result in the production of texture images. It would have been obvious to a person with ordinary skill in the art for texture values to be used as pointers because to proceed from extracting textured planes to using a lookup table, some connections have to be made between the textured planes and the lookup tables, and it is reasonable to assume that those connections would be texture values used as pointers.

29. With respect to claim 21, Pfister discloses the information of claims 16 and 22, respectively, including values for red, green, blue and opacity (“3 Texture Mapping Hardware, fifth sentence, p.3).

30. Accordingly, in view of the foregoing, claims 19 and 21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Pfister.

31. Accordingly, in view of the foregoing, claims 19 and 21-23 are rendered unpatentable under 35 U.S.C. 103(a) by the OpenGL Reference Manual and Pfister.

***Claim Rejections - 35 USC § 102***

32. The following is a quotation of 35 U.S.C. 102(b) which forms the basis for all novelty rejections set forth in this Office action:

A person shall be entitled to a patent unless—

- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or sale in this country, more than one year prior to the date of application for patent in the United States.

33. Claims 16-17 and 22-23 are rejected under 35 U.S.C. § 102(b) as being anticipated by Pfister.

34. Regarding claim 16, Pfister discloses retrieving information from a lookup table

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indicating a contribution to an image ("3 Texture Mapping Hardware", fourth sentence, p.3), compositing the retrieved information ("3 Texture Mapping Hardware", fifth sentence, p.3) and displaying the retrieved information (Fig.4, p.4).

35. With respect to claim 17, Pfister discloses the information of claim 16 including values for red, green, blue and opacity ("3 Texture Mapping Hardware, fifth sentence, p.3).

36. Concerning claim 22, Pfister discloses retrieving information from a lookup table indicating a contribution to an image ("3 Texture Mapping Hardware", fourth sentence, p.3), and compositing the retrieved information ("3 Texture Mapping Hardware", fifth sentence, p.3).

37. Regarding claim 23, Pfister discloses the information of claim 22 including values for red, green, blue and opacity ("3 Texture Mapping Hardware, fifth sentence, p.3).

38. Accordingly, in view of the foregoing, claims 16-17 and 22-23 are anticipated under 35 U.S.C. 102(b) by Pfister.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the Office should be directed to the examiner, Lance Sealey, whose telephone number is (703) 305-0026. He can be reached Monday-Friday from 7:00 am to 3:30 pm EDT.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Zimmerman, can be reached at (703) 305-9798.

**Any response to this action should be mailed to:**

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MS Non-Fee Amendment

Commissioner for Patents

P.O. Box 1450

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**or faxed to:**

**(703) 872-9306**

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

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